

## Stone Pine Forests in Siberia

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**Abstract:** Stone pine forests in Siberia are unique for their origin, area dynamics, comprehensive productivity, and biospherical role. They are mainly mature forests for the most regions. The regeneration has two main tasks: (1) to organize the rational and ecological felling for the Siberian stone pine trees, (2) to increase young growth. In the past, the main aim of the forest management was wood production. The basic elements were mainly technical exploitability and felling ages, traditional cleaning cutting, and "continuous" artificial regeneration, which are not suitable for the Siberian stone pine forests. New practices of the forest management and new theoretical principles have been developed by our Institute, including comprehensive evaluation, selection and growth, and creating new felling technology. Qualitative evaluations of every stand and every tree in the Siberian stone pine forests should be made.

**Key words:** Stone pine forest, Forest management, Utilization, Reproduction.

### Introduction

Stone pine forests in Russia are composed of three stone pine species: Siberian stone pine (*Pinus sibirica* Du Tour), Koreanstine pine (*Pinus Koraiensis* Sieb. Et Zucc.), and Japanese stone pine (*Pinus pumila* [Pall.] Regel). All these species occupy about 40 million  $\text{hm}^2$ , Siberian stone pine accounts for 90 % of the total. Ecological conditions for Siberian stone pine growth vary with latitude and altitude. These stands are critical for conservation of water resources (in mountains and near

sources of Siberian rivers, around Baikal Lake) They also serve to stabilize swamping process in West Siberian Lowland. The stone pines are pioneer tree species known in soil conservation, especially for the subalpine zone. Moreover, the Russian stone pine forests, as main forest of Eurasian boreal zone, play significant biospherical role and have the world resources value. So the stone pine forests are of paramount importance for Russia and the world. These patterns of stone pine forests demand different conditions for their management and conservation (Vorobjev 1983; Smolonogov 1994).

**Table 1. Stone pine forest area In Regions of Russian Federation**

Region	Forest area (1000 $\text{hm}^2$ )	Distribution of forest area (%)			
		Young stand	Middle- aged stand	Immature stand	Matures and over- matured stand
Russian Federation including Republics	40,371.0	8	23	23	46
Altai	894.5	8	31	30	31
Buryatiya	1,803.1	14	51	18	17
Provinces:					
Sverdlovsk	694.3	4	34	24	38
Omsk	146.8	14	57	11	18
Novosibirsk	42.3	18	41	22	19
Kemerovo	280.9	16	38	30	16
Tomsk	3,570.4	7	10	20	63
Krasnoyarsk and Khakasiya Republic	9,939.6	4	13	17	66
Irkutsk	6,884.5	17	31	24	28
Chita	956.0	22	57	14	7
Khabarovsk	640.2	3	17	22	58
Vladivostok	2,243.5	3	25	32	40

At the present, the management way of Siberian stone pine forest according to data of the Russian Federal

Forest Management Service is as follows: The Siberian stone pine forests are mainly mature forests for the most

regions (Table 1). The young growth are from 3% to 22%. The forests management has two main tasks. The first is to organize the rational and ecological felling. Mass clean cutting is unable and forbidden today. The cutting volume of the Siberian stone pine decreased (Table 2).

**Table 2. Cutting volume when green of stone pine stands in Russia(1968-1990) (Million Cubic Meters)**

Year	Volume when green
1968	8.5
1975	7.3
1980	5.8
1985	4.5
1990	3.1

The second is to increase young growth. There exists technological and economic difficulties for increasing young growth by panting. But, Siberian stone pine forests are quite well regenerated themselves. Cleaning cutting is a main way to help the natural regeneration of Siberian stone pine (Table 3). Planting should be also made but in smaller proportion and the Siberian stone pine cones should be collected in advance. 200 tons of the seeds are required in Russia.

**Table 3. Stone pine forest re-establishment and tending Operation in 1993 (1000 hm<sup>2</sup>)**

Region	Silviculture planting area	Young tree tending operation	Cleaning cutting	
			in stone pine mature stand	in birch stand
Russian Federation	32.2	13.2	9.9	5.2
including Republics:				
Altai	3.0	1.2	0.07	1.5
Khakasiya	3.2	0.3	-	-
Buryatiya	0.05	0.1	-	0.1
Provinces:				
Sverdlovsk	0.27	0.5	-	0.1
Omsk	0.06	0.2	-	1.5
Novosibirsk	1.5	0.8	0.2	0.1
Kemerovo	4.99	2.0	2.0	1.0
Tomsk	1.99	1.5	0.04	0.3
Krasnoyarsk	5.6	1.5	-	-
Irkutsk	0.76	1.3	-	-
Chita	-	-	-	-
Khabarovsk	1.6	1.6	-	0.1
Vladivostok	7.3	2.0	7.5	0.5

## Management and Reproduction

The Russian Federal Forest Management Service is working for growing the Siberian stone pine seedlings. 771.6 million seedlings were grown from 1989 to 1993.

In the future 100 to 120 million seedlings will be enough for planting. Thus traditional practices of forest management mainly include conservation, utilization, and reproduction of wood. New practices should include many ecological observations which do not change the classic schemes and technologies of the forest management.

In the past the main aim of forest management of Siberian stone pine was wood production. Its basic elements were technical exploitability and felling ages, traditional cleaning cutting, and "continuous " artificial regeneration. The main method of reproduction of Siberian stone pine forest or other coniferous forests was artificial planting. Siberian stone pine stands were established by planting 2-year seedlings on felling areas. The plantations were overgrown and were not successfully preserved for absent necessary care.

The comprehensive investigations of the Siberian stone pine forests in many regions of Siberia during last 30 years confirmed that management of these forests must be distinguished from the management of other forests. The new theoretical principles of the Siberian stone pine forests management have been developed by our Institute. They are being based on a comprehensive estimation of the Siberian stone pine forest, their selection and growth as well as the creation and control of new felling technology. The practical resolution of these problems will permit the rational use of the Siberian stone pine forest resources, the conservation of the best part of the Siberian stone pine forests for ecological purposes, the reproduction of valuable gene resources, and enhancement of recreation uses.

the goal of the Siberian stone pine forest management is not only the wood but the comprehensive utilization of all the forest resources including wood, cone, seed, oleoresin, berries, mushrooms, furs, games, and ecological and esthetic values (Vorobjev 1983; Vorobjev, Vorobjeva 1994). Technical exploitability ages, felling ages, and major production should be not used as criteria for the management.

Forest harvest should follow these comprehensive estimations. Qualitative evaluations of every stand and every tree in the Siberian stone pine forests would be made, but the middle-statistical method of the forest felling based on the correlation of age, growing-stock, and increment should not be used

The main method for the forest regeneration is the conservation of understorey in the Siberian stone pine forests during felling operations. The Siberian stone pine has good natural regeneration as a result of tree succession in herbaceous forest types. Our aim is to assist these processes. Theoretical principles of the optimal

Siberian stone pine forest reproduction are the doctrine for reproduction and age dynamics that Russian scientists developed in the Ural region (Smolonogov 1994).

It is supposed to study the mechanism of relationship between growth and generative process in the stone pines of Europe and Asia. This task is very difficult because of very long conifer ontogeny. Use of dendrochronological retrospective methods (Vorobjev et al. 1994) gives unique opportunity to reveal correlation of the growth and generative process relationship, and based on this, we develop the ecological and geographical principles of the cyclic connection (Vorobjev 1994). The information about these investigations will be used for the creation of theory of sustainable development and adaptation and for the dendrochronological reconstruction of the growth and cone production tree dynamics including prediction and response on the man-induced factors.

## Conclusion

Many new theoretical principles of the Siberian stone pine forest management may be used in other stone pine or coniferous forests. The validity of our suppositions has been confirmed by visiting Korean stone pine forests in China.

The prime scientific tasks for stone forest study are as follows:

- Study of biology and ecology of the stone pines;
- Prediction of stone pine sustainable development;
- Study of stone pine adaptation, especially in marginal growing and high-elevation areas;
- Development recommendation for reforestation and establishment of the stone pine forests based on ecological and genetic breeding information;
- Elaboration of new technology on complex stone pine forest harvesting and utilization.

A new approach to the stone pine forest management proposed in the paper is essentially as follows:

- Siberian stone pine is a cone-bearing tree, and this specific feature should be the basis of developing a modern stone pine forest strategy;
- All stone pine forests should be evaluated from viewpoint of their ecological role and total resource value but not only wood.
- The utilization of stone pine forest should rely on a comprehensive differentiation approach precluding from forest resource impoverishment;
- Forest regulation and economy should use typological and genetic properties of stone pines, taking into account their reproduction and aged dynamics, i.e. including the young stone pine trees under the deciduous

trees canopy;

- Cleaning cuttings should be allowed in stone pine forests in dependence on their cone production and ecological value;

- Regeneration of stone pine forests should be made by use of optimal combination of processes and proportion of natural regeneration and artificial reproduction without preferring of any way;

- Artificial reproduction of stone pines should be made on genetic and selection basis;

- An optimal stone pine forest management is multi-purpose use of their resources.

The world community requests conservation of environment and resource. One of the resources is stone pine forests of the Northern Hemisphere. Taking new practices about similar ecosystems is key to entirely understand ecological function of the stone pine forests.

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